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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/786,807

02/25/2004

Hui-Mei Chen

MEG02-005

3341

28112 7590 07/21/2009

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EXAMINER

AU, BAC H

ART UNIT

PAPER NUMBER

2822

MAIL DATE

DELIVERY MODE

07/21/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/786,807	<b>Applicant(s)</b> CHEN ET AL.	
	<b>Examiner</b> Bac H. Au	<b>Art Unit</b> 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 May 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 15,27,35-39 and 41 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15,27,35-39 and 41 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Applicant's amendment dated May 21, 2009, in which claims 15, 27, and 37 were amended, and claims 17, 30, and 40 were cancelled, has been entered.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kajiwara (U.S. Pub. 2003/0127747) in view of Hikita (U.S. Pub. 2003/0146518).

Regarding claim 15, Kajiwara [Fig.1] discloses a method for fabricating a circuit component, comprising:

providing a semiconductor wafer [1], a metal pad [4] over said semiconductor wafer, wherein said metal pad has a sidewall and a top surface with a first region and a second region between said first region and said sidewall, and a passivation layer [5] on said second region and over said semiconductor wafer, wherein an opening in said passivation layer is over said metal pad and first region, and said first region is at a bottom of said opening;

providing an exposed metallization structure [7] over said semiconductor wafer, over said passivation layer and on said first region, wherein said exposed metallization

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structure is connected to said first region through said opening, and wherein said exposed metallization structure comprises a metal bump used for a package interconnect [Kajiwara, in Figs.1,6,7, discloses metallization structures [7, 103, and 123/124] that are in the opening of the passivation layer [5,102], over the passivation layer 122, and directly on the passivation layer 122]; and

after said providing said exposed metallization structure, performing a sputter etching process with an argon gas [Para.39].

Kajiwara fails to explicitly disclose wherein said metal bump has a substantially vertical sidewall extending from a bottom of said metal bump to a substantially planar top surface of said metal bump. However, Hikita [Fig.1] discloses a method for fabricating a circuit component wherein said metal bump [3] has a substantially vertical sidewall extending from a bottom of said metal bump to a substantially planar top surface of said metal bump. Hikita discloses and makes obvious the suitable alternatives of various shapes of metal bumps. Because both references teach methods of forming metal bumps for external electrical connection in a semiconductor device, it would have been obvious to one skilled in the art to substitute one method for the other to achieve the predictable results of having the suitable bump design for the required device manufacturing process.

Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kajiwara (U.S. Pub. 2003/0127747) in view of Hikita (U.S. Pub. 2003/0146518), as applied to claim 15, and further in view of Dass (U.S. Pat. 6162652).

Regarding claim 35, Kaiwara discloses performing said sputter etching process, but fails to disclose wherein after said performing said sputter etching process, further comprising contacting said metal bump with a testing probe. However, Dass [Fig.17] discloses wherein a method for fabricating a circuit component further comprising contacting said metal bump [150] with a testing probe [160]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Dass into the method of Kajiwara to include wherein a method for fabricating a circuit component further comprising contacting said metal bump with a testing probe. The ordinary artisan would have been motivated to modify Kajiwara in the manner set forth above for at least the purpose of performing in-process testing of the separate component before proceeding with subsequent packaging steps to avoid additional costs in the event the component is rejected [Dass; col.1 lines 11-25].

3. Claims 27 and 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kajiwara (U.S. Pub. 2003/0127747) in view of Fan (U.S. Pat. 6956292) and Hikita (U.S. Pub. 2003/0146518).

Regarding claims 27 and 37-38, Kajiwara [Fig.1] discloses a method for fabricating a circuit component, comprising:

providing a semiconductor wafer [1], a metal pad [4] over said semiconductor wafer, wherein said metal pad has a sidewall and a top surface with a first region and a second region between said first region and said sidewall, and a passivation layer [5]

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over said semiconductor wafer and on said second region, wherein an opening in said passivation layer is over said first region, and said first region is at a bottom of said opening;

providing an exposed metallization structure [7] over said semiconductor wafer, over said passivation layer; directly on said passivation layer; and on said first region, wherein said exposed metallization structure is connected to said first region through said opening, and wherein said exposed metallization structure comprises a metal bump used for a package interconnect [Kajiwara, in Figs.1,6,7, discloses metallization structures [7, 103, and 123/124] that are in the opening of the passivation layer [5,102], over the passivation layer 122, and directly on the passivation layer 122].

Kajiwara discloses after said providing said exposed metallization structure, performing a sputter etching process with an argon gas [Para.39]. Kajiwara fails to explicitly disclose performing an ion milling process with an argon gas; with an inert gas. However, Fan [Col.5 lines 12-14] discloses performing an ion milling process with an argon gas; with an inert gas. Fan discloses and makes obvious that sputter etching and ion milling are suitable alternative processes. Because both references teach methods of cleaning of metal surfaces with ions, it would have been obvious to one skilled in the art to substitute one method for the other to achieve the predictable results of having an effective method of cleaning metal surfaces, particularly metal bumps.

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Kajiwara fails to explicitly disclose wherein said metal bump has a substantially vertical sidewall extending from a bottom of said metal bump to a substantially planar top surface of said metal bump. However, Hikita [Fig.1] discloses a method for fabricating a circuit component wherein said metal bump [3] has a substantially vertical sidewall extending from a bottom of said metal bump to a substantially planar top surface of said metal bump. Hikita discloses and makes obvious the suitable alternatives of various shapes of metal bumps. Because both references teach methods of forming metal bumps for external electrical connection in a semiconductor device, it would have been obvious to one skilled in the art to substitute one method for the other to achieve the predictable results of having the suitable bump design for the required device manufacturing process.

Claims 36 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kajiwara (U.S. Pub. 2003/0127747) in view of Fan (U.S. Pat. 6956292) and Hikita (U.S. Pub. 2003/0146518), as applied to claims 27 and 37 above, and further in view of Dass (U.S. Pat. 6162652).

Regarding claims 36 and 41, the limitations of the claims were already addressed above in the treatment of claim 35.

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kajiwara (U.S. Pub. 2003/0127747) in view of Fan (U.S. Pat. 6956292) and Hikita (U.S. Pub.

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2003/0146518), as applied to claim 37 above, and further in view of Zhang (U.S. Pat. 6104461).

Regarding claim 39, Kajiwara and Fan disclose wherein said inert gas comprises an argon gas, but fails to disclose a helium gas. However, Zhang [Col.10 lines 63-65] discloses wherein said inert gas comprises a helium gas. Zhang makes it obvious that ion milling can be done with either argon or helium, which can be used as suitable alternatives in the ion milling process. Because all three references teach methods of sputtering or ion milling with an inert gas, it would have been obvious to one skilled in the art to substitute one method for the other to achieve the predictable results of having an effective method of etching or cleaning metal surfaces.

### ***Response to Arguments***

4. Applicant's arguments filed May 21, 2009 have been fully considered but they are not persuasive. With regards to claims 15, 27, and 37, Applicant asserts "It is believed to be unobvious to apply Hikita et al.'s metal bump 3 to Kajiwara et al.'s Au bump 7 because both Kajiwara et al. and Hikita et al. fail to teach, hint or suggest that an electroplated or electroless plated metal bump, such as Hikita et al.'s metal bump 3, need to be sputter etched." This assertion is not persuasive. Hikita was not necessarily relied upon to disclose sputter etching. As elucidated above, Hikita was applied to disclose and make obvious the various shapes of metal bumps. A rationale was provided for combining Hikita with Kajiwara, and their combination is deemed proper.

Overall, Applicant's arguments are not persuasive. The claims stand rejected.



***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bac H. Au whose telephone number is 571-272-8795. The examiner can normally be reached on Mon-Fri 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Bac H Au/  
Examiner, Art Unit 2822

/Kevin M. Picardat/  
Primary Examiner, Art Unit 2822